INTERFACE TOUGHNESS MEASUREMENT OF ENVIRONMENTAL BARRIER COATINGS FOR SiC/SiC COMPOSITES

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A simple interface fracture test for ceramics coatings on ceramics matrix composites was developed. A kind of asymmetric double cantilever beam (ADCB) test was proposed so that the interface fracture toughness could be measured by a small and simple-shape specimen without applying inter-laminar shear or tensile loading to CMC substrate. The proposed test was applied to a classic environmental barrier coating (EBC) consisting of mullite layer and Si bond coat on monolithic SiC substrate. A small block specimen of ~3×4×3 mm was cut from the coated substrate, and a notch was machined along the interface. The notch was opened by inserting a wedge to the notch; the notch opening displacement at the notch root was measured. From the critical notch opening displacement and load where the crack starts to propagate, interface fracture toughness was calculated.

Several studies have reported that the reaction product is formed at the interface of various multilayer EBC systems with a Si bond coat, and the reaction product may cause the degradation of interface adhesion. To investigate the effect of such reaction products, the test was also applied to the heat-exposed EBC. The interface toughness after the heating was measured as a function of exposure time. The interface toughness varied with exposure time. Formation of a reaction products was observed at the interface during the heating; they grew with exposure time. The variation of the toughness was discussed based on the interface observation and was correlated to the interface reaction products.